

## 3.2. NAVIGATION SYSTEMS TEST TECHNIQUES

### 3.2.1. Preflight and Built in Tests

#### 3.2.1.1. Purpose

The purpose of this test is to assess the suitability of the navigation system preflight and turn on procedure and the BIT to quickly and easily bring the navigation system on line and insure an operating system once airborne.

#### 3.2.1.2. General

As airplanes become more expensive, fewer and fewer will be available to accomplish each mission, amplifying the loss of individual airplanes to inflight failures. Quick, accurate ground preflight tests are essential to determine system status while repair can still be affected. This requirement is particularly important for navigation systems included in highly integrated, modern aircraft since nearly all systems require an accurate navigation input to function correctly. Quick response/alert time is also important and so these checks must be expeditious and must allow the operator to prepare for the mission with a minimum of distractions. Limited airplane availability also implies the need for quick turn arounds to send the same aircraft out for successive missions.

Many aircraft systems can be turned on after the aircraft is airborne; however, this is often not the case for navigation systems since the pilot must begin navigating at takeoff, particularly on night and bad weather flights. For INS systems, the preflight and turn on sequence must be performed serially before the initialization and alignment process. The INS initialization and alignment process is often the longest procedure required to get the aircraft ready for flight and so the serially dependent preflight and turn on procedure must be as expeditious as possible. Radio navigation aids, such as OMEGA or GPS, require preflight and turn on before the system can begin acquiring the stations and integrating to a solution, also requiring a rapid preflight and turn on procedure. Although the BIT can often be performed during the initialization and alignment process in INS systems and during acquisition and integration for radio navigation systems, the BIT results must

be known as accurately and quickly as possible so that failures can be repaired and the long process begun again. The entire procedure must be accomplished safely and thoroughly before a hurried combat mission.

#### 3.2.1.3. Instrumentation

A stop watch and data cards are required for this test. A voice tape recorder is optional.

#### 3.2.1.4. Data Required

Qualitative comments, time to complete the preflight/turn on and time to complete the BIT are required. A record of BIT indications is required.

#### 3.2.1.5. Procedure

Perform a normal navigation system turn on before each test flight using the published system check list. Note the time for preflight and turn on up to the point of initialization and alignment. Perform a preflight BIT, noting the total BIT time and indications. Note any correlation between the BIT indications and the navigation system's operation. Perform a complete check of the failure indications on the ground. Make qualitative comments as appropriate.

#### 3.2.1.6. Data Analysis and Presentation

The time and complexity of the navigation system preflight and turn on procedures should be related to the expected alert launch time requirements and the overall operator workload during the alert launch. Note other serial requirements following the preflight, turn on and BIT before the system can provide airborne navigation and relate them to the requirement for accurate navigation information immediately following takeoff during night and bad weather flying. The BIT times and the amount of operator interface required to perform the BIT should be assessed in the same scenario. Clarity of the BIT indications should be related to the cockpit environment. The BIT indications should be related to actual navigation system degradation and verified by ground technicians. Erroneous BIT false alarms should be noted and related to the probability of unnecessarily missed sorties.

**3.2.1.7. Data Cards**

Sample data cards are presented as cards  
34 and 35.

CARD NUMBER \_\_\_\_\_

NAVIGATION SYSTEM PREFLIGHT/TURN ON

CLARITY OF CHECKLIST INSTRUCTIONS:

LOGICAL SEQUENCE OF CHECKLIST:

THOROUGHNESS OF CHECKLIST:

TOTAL PREFLIGHT/TURN ON TIME \_\_\_\_\_

DEPENDENCY OF OTHER AIRCRAFT SYSTEMS UPON THE NAVIGATION SYSTEM PREFLIGHT/TURN ON:

CARD NUMBER \_\_\_\_

NAVIGATION SYSTEM BUILT IN TESTS

INITIATION PROCEDURES:

RUN/FINISH INDICATIONS:

EFFECTS OF THE BIT UPON THE INITIALIZATION/ALIGNMENT (i.e., SERIAL OR CONCURRENT):

BIT FAILURES AND QUALITATIVE FUNCTIONAL ASSESSMENT OF THE NAVIGATION SYSTEM/RESULTS  
OF GROUND MAINTENANCE CHECKS: